In The Claims

Please amend claims 1-9, 12-17, 24-27, 29-31, 33-36, 38, 44, 46, and 49-53, please cancel claims 20, 37, 39-41, 43, and 45, and please enter new claims 54-63 as presented below:

1. (Amended) A method of determining a consistency of stock comprising:

(a) providing a refiner having a pair of spaced apart and opposed refiner plates that define a refining zone therebetween, a sensor disposed in the refiner that senses a parameter of the refining zone ~~inside the refiner~~, a processor, and a link between the sensor and the processor;

(b) sensing a parameter inside the refiner;

(c) communicating the sensed parameter to the processor; and

(d) determining consistency of stock flowing through the refiner in real time during refiner operation using the sensed parameter and an initial consistency value.

2. (Amended) The method according to claim 1 wherein the sensor comprises a temperature sensor, there are a plurality of temperature sensors, and the sensed parameter comprises a temperature inside the ~~refiner~~ refining zone.

3. (Amended) The method according to claim ~~2~~ 1 wherein the processor comprises a DCS ~~refiner has a refining zone therein and the temperature inside the refiner is a temperature in the refining zone~~.

4. (Amended) The method according to claim ~~3~~1 further comprising a DCS and a link between the processor and the DCS ~~wherein the temperature sensor is disposed in the refining zone~~.

5. (Amended) The method according to claim ~~4~~ 2 wherein ~~the refiner further comprises a pair of spaced apart and opposed refiner plates and the~~ each temperature sensor is disposed in one of the refiner ~~plates~~disks and the sensed parameter comprises a temperature of stock in the refining zone.

6. (Amended) The method according to claim 1 wherein the sensor comprises a pressure sensor, there are a plurality of pressure sensors, and the sensed parameter comprises a pressure inside the ~~refiner~~ refining zone.

7. (Amended) The method according to claim 6 wherein each pressure sensor is disposed in one of the refiner disks and the sensed parameter comprises a pressure of stock in the refining zone ~~the refiner has a refining zone therein and the pressure inside the refiner is a pressure in the refining zone~~.

8. (Amended) The method according to claim ~~7~~ 1 wherein the sensed parameter comprises a temperature and a pressure ~~pressure sensor is disposed in the refining zone.~~

9. (Amended) The method according to claim ~~8~~ 1 wherein the link between sensor and the processor further comprises a signal conditioner, and further comprising a DCS and a second link between the processor and the DCS~~wherein the refiner further comprises a pair of spaced apart and opposed refiner plates and the pressure sensor is disposed in one of the refiner plates~~.

10. (Original) The method according to claim 1 wherein the sensed parameter is communicated to the processor via the link between the sensor and the processor.

11. (Original) The method according to claim 10 further comprising a signal conditioner disposed between the sensor and the processor that receives a signal from the sensor and outputs a conditioned signal to the processor.

12. (Amended) The method according to claim 1 wherein the refiner has ~~a refining zone therein and~~ a motor that provides power to the refiner, the sensed parameter comprises a temperature or pressure in the refining zone, and consistency is determined using the sensed parameter, and a distribution of motor load in the refining zone~~, and an initial consistency value~~.

13. (Amended) The method according to claim 1 wherein ~~the refiner has a refining zone therein,~~ the sensed parameter comprises a temperature or pressure in the refining zone, and consistency is determined using the sensed temperature or pressure, and specific power~~, and an initial consistency value~~.

14. (Amended) The method according to claim 1 wherein ~~the refiner has a refining zone therein,~~ the sensed parameter comprises a temperature or pressure in the refining zone, and consistency is determined using the sensed temperature or pressure, specific steam generation rate, dry wood throughput, latent heat of steam, specific power, wood heat capacity, and water heat capacity~~, and an initial consistency value~~.

15. (Amended) The method according to claim 1 wherein ~~the refiner has a refining zone therein,~~ the sensed parameter comprises a temperature or pressure in the refining zone, and consistency is determined as a function of radial position in the refining zone using the sensed parameter, and specific power~~, and an initial consistency value~~.

16. (Amended) The method according to claim 1 wherein the refiner has a refining zone therein, the sensed parameter comprises a stock temperature or stock pressure in the refining zone, and consistency is determined as a function of radial position in the refining zone using the sensed temperature or pressure, specific steam generation rate, dry wood throughput, latent heat of steam, specific power, wood heat capacity, and water heat capacity~~, and an initial consistency value~~.

17. (Amended) The method according to claim 1 wherein ~~the refiner has a refining zone therein,~~ the sensed parameter comprises a temperature or pressure in the refining zone, and consistency is based on the following equation:

$$C = \frac{1}{1+Z}$$

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18. (Original) The method according to claim 17 wherein the variable Z is determined using the following equation:

$$Z(r) = Z(r_i)\left(\frac{L(r)}{L(r_i)}\right)^{\frac{H_l}{\beta}} + \frac{H_s}{H_l}\left[\left(\frac{L(r)}{L(r_i)}\right)^{\frac{H_l}{\beta}} - 1\right] - \frac{2\pi}{\dot{m}} L(r)^{\frac{H_l}{\beta}} \int r\overline{W}(r)L(r)^{\left(-\frac{H_l}{\beta}-1\right)} dr$$

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19. (Original) The method according to claim 18 wherein the variable L(r) is a value for the latent heat of steam based on the sensed temperature or pressure and is determined using the following equation:

$$L(r) = \alpha + \beta T(r)$$

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20. (Canceled)

21. (Original) The method according to claim 1 further comprising a controller and the further step of the controller using the determined consistency to control some aspect of operation of the refiner.

22. (Original) The method according to claim 21 wherein the controller adjusts the mass flow rate of fiber into the refiner using the determined consistency.

23. (Original) The method according to claim 21 wherein the controller adjusts the flow rate of dilution water using the determined consistency.

24. (Amended) A method of determining a consistency of stock ~~in a refiner~~ comprising:

(a) providing a refiner with a plurality of spaced apart and opposed refiner plates that define a refining zone therebetween, a sensor disposed in one of the plates that senses a parameter in the refining zone, and a processor that communicates with the sensor ~~and the processor~~;

(b) sensing a parameter inside the refining zone;

(c) communicating the sensed parameter to the processor; and

(d) determining a consistency of stock using the sensed parameter, a distribution of motor load in the refining zone or specific power, and initial consistency.

25. (Amended) A method of determining a consistency of stock ~~in a refiner~~ comprising:

(a) providing a refiner with a plurality of spaced apart and opposed refiner plates that define a refining zone therebetween, a sensor disposed in one of the plates that senses a parameter in the refining zone, and a processor that is in communication with the sensor;

(b) sensing a parameter inside the refining zone;

(c) outputting a signal;

(d) processing the signal to obtain a temperature or pressure in the refining zone; and

(e) determining a consistency of stock using the temperature or pressure obtained, specific steam generation rate, dry wood throughput, latent heat of steam, wood heat capacity, and water heat capacity.

26. (Amended) A method of determining a consistency of stock in a refiner comprising:

(a) providing a refiner with a plurality of spaced apart and opposed refiner plates that define a refining zone therebetween, a sensor disposed in one of the plates that provides a parameter in the refining zone, and a processor that is in communication with the sensor;

(b) obtaining a parameter inside the refining zone; and

(c) determining a consistency of stock in the refiner as a function of position or location in the refining zone using the obtained parameter, and a distribution of motor load in the refining zone or specific power.

27. (Amended) A method of determining a consistency of stock in a refiner comprising:

(a) providing a refiner with a plurality of spaced apart and opposed refiner plates that define a refining zone therebetween, a sensor disposed in the refiner that provides a temperature or pressure inside the refiner, and a processor that is in communication with the sensor;

(b) obtaining a temperature or pressure inside the refiner; and

(c) determining a consistency of stock in the refiner during refiner operation using the obtained temperature or pressure, a refiner load or a refiner power, a latent heat of steam, a wood heat capacity, and a water heat capacity.

28. (Original) A method of determining a consistency of stock in a refiner comprising:

(a) providing a refiner with a plurality of spaced apart and opposed refiner plates that define a refining zone therebetween, a sensor disposed in the refiner that provides a temperature or pressure inside the refiner, and a processor that is in communication with the sensor;

(b) obtaining a temperature or pressure inside the refiner;

(c) determining a latent heat of steam based on the obtained temperature or pressure using the following equation:

$$L(r) = \alpha + \beta T(r)$$

(d) determining a value Z(r) using the latent heat of steam calculated in step (c) using the following equation:

$$Z(r) = Z(r_i)\left(\frac{L(r)}{L(r_i)}\right)^{\frac{H_l}{\beta}} + \frac{H_s}{H_l}\left[\left(\frac{L(r)}{L(r_i)}\right)^{\frac{H_l}{\beta}} - 1\right] - \frac{2\pi}{\dot{m}} L(r)^{\frac{H_l}{\beta}} \int r\overline{W}(r) L(r)^{\left(-\frac{H_l}{\beta}-1\right)} dr$$

(e) determining a value C(r) using the value of Z(r) calculated in step (d) using the following equation:

$$C = \frac{1}{1+Z}.$$

29. (Amended) A method of determining a consistency of stock in a refiner comprising:

(a) providing a refiner with a plurality of spaced apart and opposed refiner plates that define a refining zone therebetween, a sensor disposed in the refiner that provides a temperature or pressure inside the refiner, and a processor that is in communication with the sensor;

(b) obtaining a temperature or pressure inside the refiner; and

(c) determining a consistency of stock in the refiner in real time during refiner operation using the obtained temperature or pressure, a specific steam generation rate, a dry wood throughput, a latent heat of steam, a wood heat capacity, and a water heat capacity.

30. (Amended) A method of determining a consistency of stock in a refiner comprising:

(a) providing a refiner that has a plurality of spaced apart and opposed refiner plates that define a refining zone therebetween, a motor that rotates one of the plates and which has a load during rotating the one of the refiner plates, a sensor disposed in one of the refiner plates that is used to obtain ~~the refiner that senses~~ a temperature or pressure of stock inside the refining zone ~~refiner~~, a processor, and a link between the sensor and the processor;

(b) ~~sensing~~ obtaining a temperature or pressure of stock inside the refining zone ~~refiner~~;

(c) determining a distribution of motor load in the refining zone or refiner specific power; and

(d) determining a consistency of stock in the refining zone using the ~~sensed~~ temperature or pressure obtained in step (b), the distribution of motor load in the refining zone or refiner specific power obtained in step (c), and an initial estimated value of consistency.

31. (Amended) A system ~~of~~ for determining a consistency of a stock in a refiner, the system comprising:

(A) a plurality of refiner discs defining a refining zone;

(B) a sensor carried by the refiner that detects a process condition related to ~~the consistency~~ a physical property of the stock from which a signal can be obtained therefrom~~and outputs a signal~~;

(C) a signal conditioner that receives and conditions the signal; and

(D) a processor that receives the conditioned signal and that determines consistency of stock being refined during refiner operation using the conditioned signal, and at least a plurality of a refiner main motor power, a force exerted on the refiner discs urging them together, a dilution motor power, a refiner case pressure, a refiner inlet pressure, a chip washing water temperature, a dilution water temperature, and an amount of a gap between the refiner discs.

32. (Original) The system of claim 31 further comprising a controller that compares the determined consistency to a consistency setpoint and provides an output in response thereto that is used to control some aspect of operation of the refiner.

33. (Original) The system of claim 32 wherein the output of the controller is used ~~controller~~ in controlling some aspect of refiner operation to cause the determined consistency to converge with or toward the consistency setpoint.

34. (Amended) The system of claim 31 further comprising an array of sensors disposed in the refiner, wherein each sensor detects a process condition related to the consistency of the stock or used in determining the consistency of the stock.

35. (Amended) The system of claim ~~31~~34, wherein the process condition detected is a temperature of the stock, wherein the processor averages the temperatures detected by the array of sensors, and wherein the processor determines the consistency of the stock using the average of the temperatures.

36. (Amended) The system of claim ~~31~~34, wherein the process condition detected is a temperature of stock entering the refiner and a temperature of stock in the refining zone, wherein the processor averages the temperatures detected by the array of sensors, and wherein the processor determines the consistency of the stock using the average of the temperatures

37. (Canceled)

38. (Amended) The system of claim 31 further comprising a controller that is used to regulate some aspect of operation of ~~regulates~~ the refiner in real time during refiner operation using the determined consistency.

39. (Canceled)

40. (Canceled)

41. (Canceled)

42. (Original) The system of claim 31 wherein the sensor is located upstream of the refining zone.

43. (Canceled)

44. (Amended) The system of claim ~~43~~ 31 wherein the conditioned signal from the sensor is used to detects or obtain a ~~the~~ temperature of the stock in the refining zone.

45. (Canceled)

46. (Amended) The system of claim 31 further comprising a pump that introduces dilution water into the disc refiner at a flow rate that can be varied, wherein the processor provides a control output that alters a flow rate of a dilution water entering the disc refiner in response to the consistency determined.

47. (Original) The system of claim 31 wherein the processor provides a control output that alters a volumetric flow rate of the stock entering the disc refiner in response to the consistency determined.

48. (Original) The system of claim 31 further comprising a feed screw that has a rate of rotation that can be varied to change the mass flow rate of fiber entering the refiner and wherein the processor provides a control output that alters the rate of rotation of the feed screw in response to the consistency determined.

49. (Amended) The system of claim 31 wherein the processor comprises a DCS ~~process variable detected is a pressure in the refiner~~.

50. (Amended) The system of claim ~~49~~31 further comprising a DCS that communicates with the processor~~wherein the process variable detected further comprises a temperature~~.

51. (Amended) A system ~~of~~ for determining a consistency of a stock in a refiner, the system comprising:

(A) a plurality of refiner plates defining a refining zone in which the stock is refined;

(B) a sensor disposed in one of the refiner plates from which a temperature or pressure in the refining zone is determined; and

(C) a processor that determines consistency of the stock flowing through the refiner using the determined temperature or pressure, refiner main motor power, force exerted on the refiner discs urging them together, refiner case pressure, and refiner inlet pressure.

52. (Amended) A system ~~of~~ for determining ~~a~~stock consistency ~~of a stock in a refiner, the system~~ comprising:

(A) a plurality of refiners that each refine a fibrous stock slurry;

(B) each refiner having a plurality of refiner plates defining a refining zone in which the stock is refined;

(~~B~~C) a plurality of sensors disposed in one of the refiner plates of each refiner from which at least one temperature or pressure in the refining zone of the corresponding refiner is determined; and

(~~C~~D) a processor that determines consistency of the stock in each refiner in real time using at least one of the determined temperatures or pressures for the corresponding refiner.

53. (Amended) A system ~~of~~ for determining ~~a~~ stock consistency ~~of a stock in a refiner, the system~~ comprising:

(A) a plurality of rotary disk refiners;

(B) each refiner having a plurality of annular and opposed refiner plates defining a refining zone in which ~~the~~ stock is refined;

(~~B~~C) an array of sensors disposed in one of the refiner plates of each refiner that output signals relating to a characteristic of the stock in the refiner;

A1 Cont'd

(~~C~~D) a signal conditioner that receives the output signals from ~~the~~ each array of sensors and outputs conditioned signals; ~~and~~

(~~C~~E) a processor that uses the conditioned signals to determine consistency of the stock in ~~the~~each refiner; and

(F) a DCS that communicates data to the processor for the corresponding refiner that is used in determining the consistency of the stock of the corresponding refiner.

Please add the following new claims:

54. (New) The method according to claim 24 further comprising a DCS that is linked to the processor that is configured to provide the processor in real time during refiner operation in step (d) at least one of the (i) distribution of motor load in the refining zone and (ii) specific power.

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55. (New) The method according to claim 24 further comprising a controller that is linked to the processor that is configured to affect some aspect of refiner operation using the consistency determined in step (d) and comprising the further step of using the consistency determined in step (d) to affect some aspect of refiner operation.

56. (New) The method according to claim 55 wherein the controller is configured to affect refiner operation to keep the determined consistency at or within a predetermined range of a consistency setpoint or threshold.

57. (New) The method according to claim 25 wherein the processor comprises a controller that is configured to affect some aspect of refiner operation using the consistency determined in step (e) and comprising the further step of using the consistency determined in step (e) to affect some aspect of refiner operation.

58. (New) The method according to claim 57 wherein the processor is configured to affect refiner operation in a manner that keeps the determined consistency at or within a predetermined range of a consistency setpoint or threshold.

59. (New) The method according to claim 26 wherein the processor comprises a controller that is configured to affect some aspect of refiner operation using the consistency determined in

step (c) and comprising the further step of using the consistency determined in step (c) to affect some aspect of refiner operation.

60. (New) The method according to claim 59 wherein the processor is configured to affect refiner operation in a manner that keeps the determined consistency at or within a predetermined range of a consistency setpoint or threshold.

61. (New) The method according to claim 29 further comprising a controller that is linked to the processor that is configured to affect some aspect of refiner operation using the consistency determined in step (c) and comprising the further step of using the consistency determined in step (c) to affect some aspect of refiner operation.

62. (New) The method according to claim 30 further comprising a controller that is linked to the processor that is configured to affect some aspect of refiner operation using the consistency determined in step (c) and comprising the further step of using the consistency determined in step (c) to affect some aspect of refiner operation.

63. (New) The system according to claim 53 wherein the array of sensors comprises at least three radially spaced apart temperature sensor that each provide a signal from which a temperature of stock in the refining zone can be obtained and wherein there is a single signal conditioner that receives sensor signals from each sensor array of each refiner.

64. (New) The system according to claim 53 wherein the processor comprises a computer, the DCS is linked by wiring to the computer, the DCS provides data related to refiner power or refiner load to the computer, and the computer is configured to use the data relating to refiner power or refiner load in determining stock consistency.

65. (New) A system for determining stock consistency comprising:

a plurality of rotary disk refiners that each comprise a plurality of refiner plates defining a refining zone therebetween in which stock is refined, a temperature or pressure sensor disposed in a refining surface one of the refiner plates; and a plurality of pairs of sensors from which refiner motor power, refiner disk force, and refiner disk gap can be obtained or determined;

a processor that obtains or determines data including (a) a temperature or pressure of stock in the refining zone, (b) refiner motor power, (c) refiner disk force, and (d) refiner disk gap and uses the temperature or pressure, the refiner motor power, the refiner disk force, and the refiner disk gap in determining stock consistency.

66. (New) The system according to claim 65 further comprising a DCS that is linked to the processor that is configured to provide the processor with at least some data that is used in determining stock consistency.

67. (New) The system according to claim 65 wherein the processor comprises a DCS that is configured with software used in determining stock consistency.

68. The system according to claim 65 wherein the processor is configured to determine stock consistency by:

obtaining a latent heat of steam, L(r), based on the obtained temperature or pressure with the following equation:

$$L(r) = \alpha + \beta T(r)$$

obtaining a value, Z(r), using the latent heat of steam, L(r), with the following equation:

$$Z(r) = Z(r_i)\left(\frac{L(r)}{L(r_i)}\right)^{\frac{H_l}{\beta}} + \frac{H_s}{H_l}\left[\left(\frac{L(r)}{L(r_i)}\right)^{\frac{H_l}{\beta}} - 1\right] - \frac{2\pi}{\dot{m}} L(r)^{\frac{H_l}{\beta}} \int r\overline{W}(r)L(r)^{\left(-\frac{H_l}{\beta}-1\right)} dr$$

; and

obtaining a value of consistency as a function of radial position within the refining zone, C(r), using the value of Z(r) using the following equation set forth below:

$$C = \frac{1}{1+Z}$$

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69. (New) A system for determining stock consistency comprising:

a plurality of rotary disk refiners that each comprise a plurality of refiner plates defining a refining zone therebetween in which stock is refined, a temperature or pressure sensor disposed in a refining surface one of the refiner plates; and a plurality of pairs of sensors from which refiner motor power, refiner disk force, and refiner disk gap can be obtained or determined;

a processor;

a DCS;

wherein one of the processor and the DCS is configured to obtain or determine for each refiner a plurality of (a) a temperature or pressure of stock in the refining zone, (b) refiner motor power, (c) refiner disk force, and (d) refiner disk gap;

wherein the other one of the processor and the DCS is configured to obtain or determine for each refiner a remainder of (a) a temperature or pressure of stock in the refining zone, (b) refiner motor power, (c) refiner disk force, and (d) refiner disk gap; and

wherein one of the processor and the DCS is configured to use the temperature or pressure, the refiner motor power, the refiner disk force, and the refiner disk gap in determining stock consistency for each corresponding refiner.

70. (New) A system for determining and using stock consistency comprising:

a plurality of rotary disk refiners that each comprise a plurality of annular refiner plates defining a refining zone therebetween in which stock is refined, and a temperature or pressure sensor carried by one of the refiner plates that provides an output from which a temperature or pressure of stock in the refining zone is obtainable;

a processor configured to obtain a temperature or pressure of stock in the refining zone of each refiner and determine a consistency of stock using the obtained temperature or pressure; and

a controller configured to use the determined stock consistency of each refiner to affect some aspect of operation of the corresponding refiner.

71. (New) The system according to claim 70 wherein the processor comprises the controller.

72. (New) The system according to claim 70 further comprising a DCS that is configured to provide the processor with data used in determining the determined stock consistency.

73. (New) A system for determining and using stock consistency comprising:

a plurality of rotary disk refiners that each comprise a plurality of annular refiner plates defining a refining zone therebetween in which stock is refined, and a temperature or pressure sensor carried by one of the refiner plates that provides an output from which a temperature or pressure of stock in the refining zone is obtainable;

a processor configured to obtain a temperature or pressure of stock in the refining zone of each refiner and determine a consistency of stock using the obtained temperature or pressure; and

a controller configured to regulate some aspect of operation for each refiner using the determined stock consistency of the corresponding refiner to keep the determined consistency at a consistency setpoint or within a consistency range.

74. (New) A system for determining stock consistency comprising:

a plurality of rotary disk refiners that each comprise a plurality of refiner plates defining a refining zone therebetween in which stock is refined, a temperature or pressure sensor disposed in the refiner; and a plurality of pairs of sensors from which refiner motor power, refiner disk force, and refiner disk gap can be obtained or determined;

a processor that obtains or determines, for each rotary disk refiner, (a) a temperature or pressure of stock in the refiner, (b) refiner motor power, (c) refiner disk force, (d) refiner disk gap, (e) specific steam generation rate, (f) dry wood throughput, (g) latent heat of steam, (h) specific power, (i) wood heat capacity, (j) water heat capacity and uses at least the temperature or pressure of stock in the refiner, specific steam generation rate, dry wood throughput, latent heat of steam, specific power, wood heat capacity, water heat capacity in determining stock consistency for the corresponding rotary disk refiner.

75. The system according to claim 74 further comprising a DCS that is linked to the processor that is configured to provide the processor with plurality of refiner motor power, refiner disk force, and refiner disk gap that is used in determining stock consistency.